Hole's Human Anatomy and Physiology

Twelfth Edition

Shier ◆ Butler ◆ Lewis

Chapter 11

Nervous System II: Divisions of the Nervous System

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11.1: Introduction

- The central nervous system (CNS) consists of the brain and spinal cord.
- The brainstem connects the brain to the spinal cord.
- Communication to the peripheral nervous system (PNS) is by way of the spinal cord.

11.2: Meninges

- The meninges
  - Membranes of CNS
  - Protect the CNS
  - Three (3) layers:
    - Dura mater
      - "Tough mother"
    - Arachnoid mater
      - "Spiderweb-like"
      - Space contains cerebrospinal fluid (CSF)
    - Pia mater
      - "Faithful mother"
      - Encapsulates

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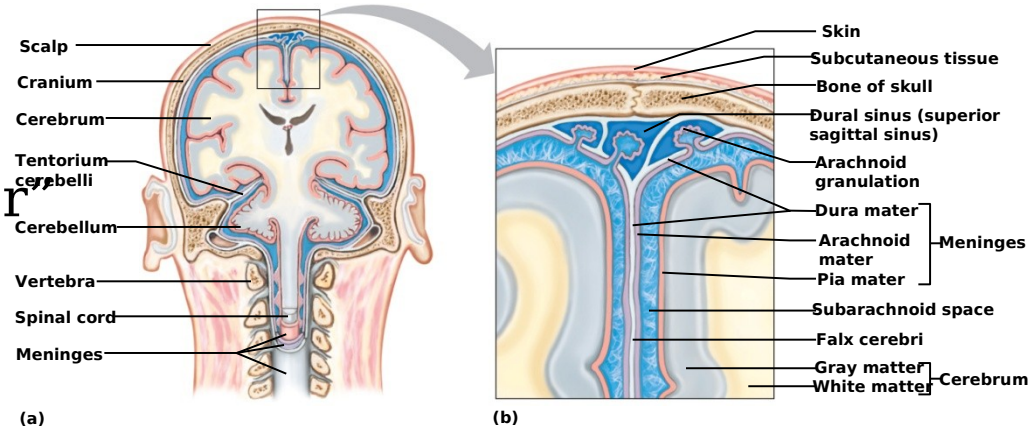

Meninges of the Spinal Cord

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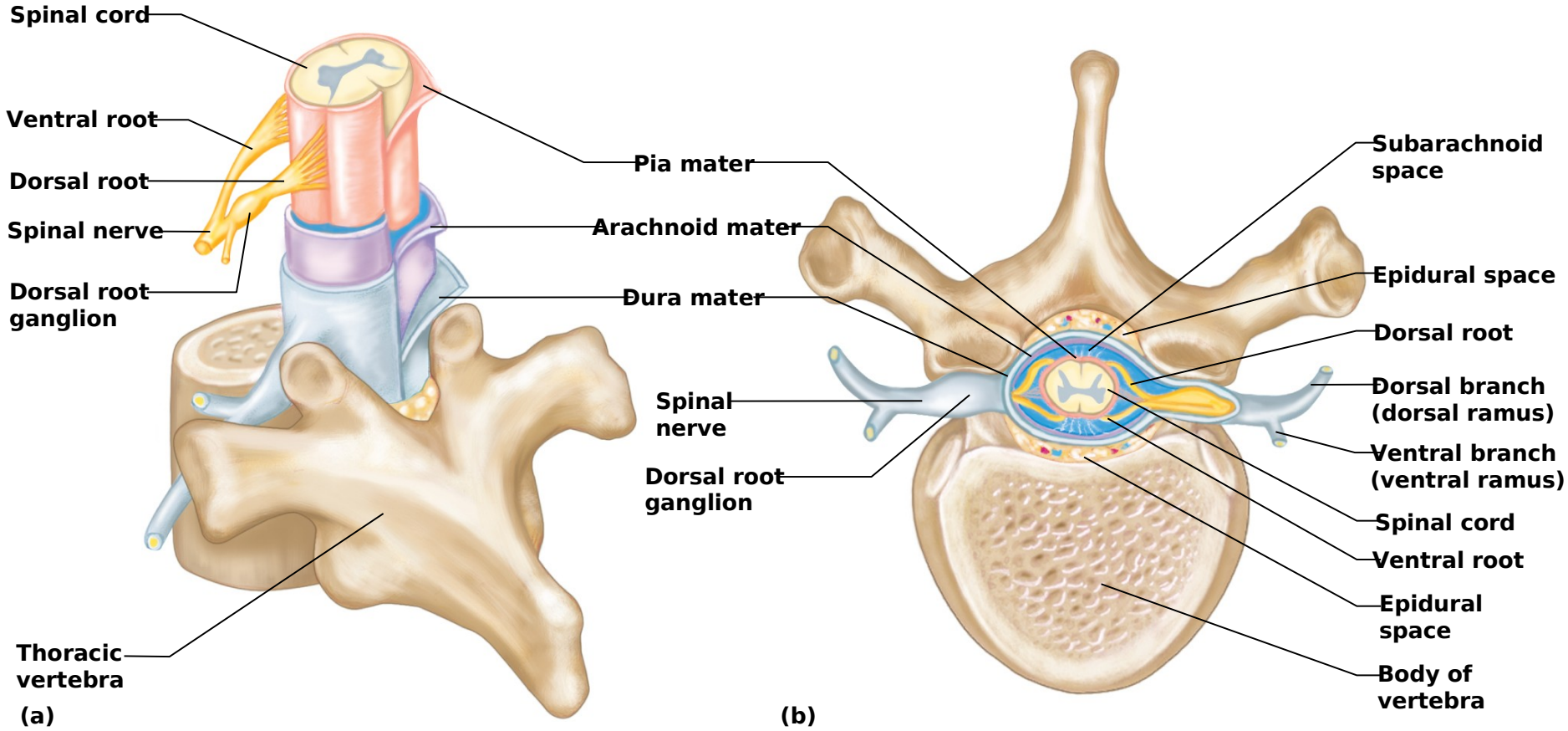

11.3: Ventricles and Cerebrospinal Fluid

- There are four (4) ventricles
- The ventricles are interconnected cavities within cerebral hemispheres and brain stem
- The ventricles are continuous with the central canal of the spinal cord
- They are filled with cerebrospinal fluid (CSF)

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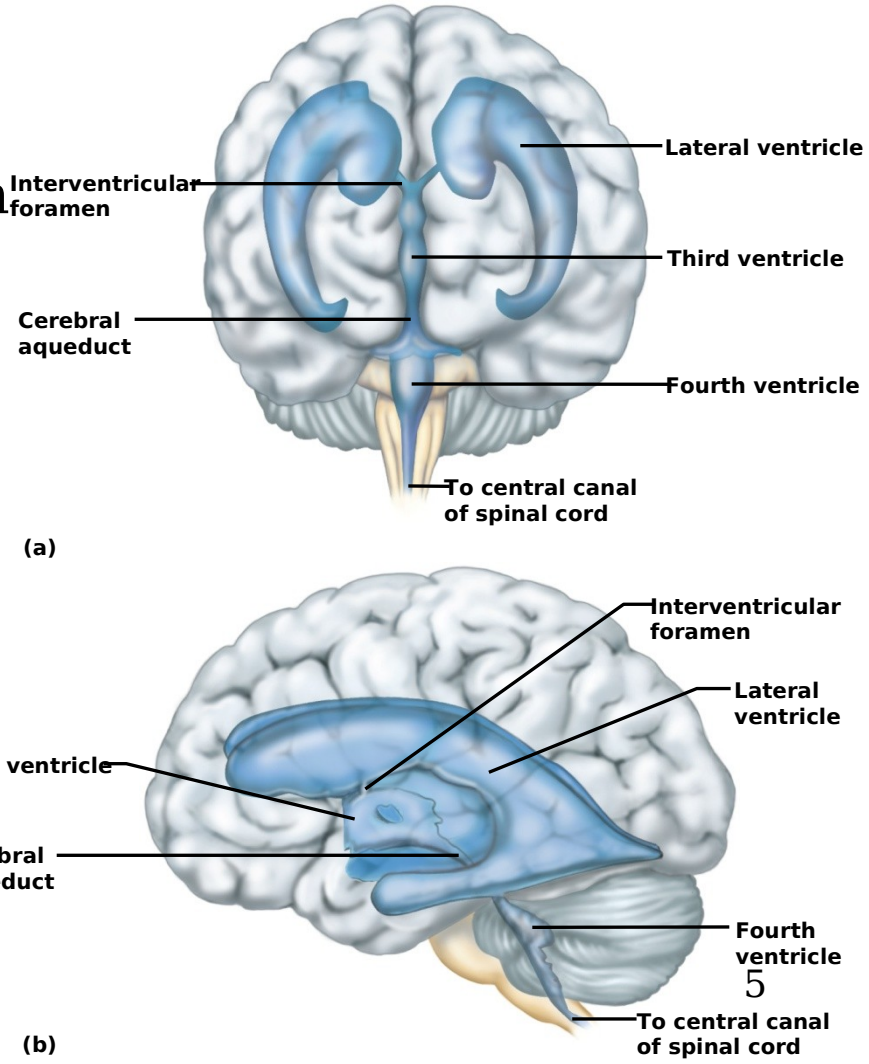

Cerebrospinal Fluid

- Secreted by the choroid plexus (Can you recall the specific cells?)
- Circulates in ventricles, central canal of spinal cord, and the subarachnoid space
- Completely surrounds the brain and spinal cord
- Excess or wasted CSF is absorbed by the arachnoid granulations
- Clear fluid similar to blood plasma
- Volume is only about 120-140 ml.
- Nutritive and protective
- Helps maintain stable ion

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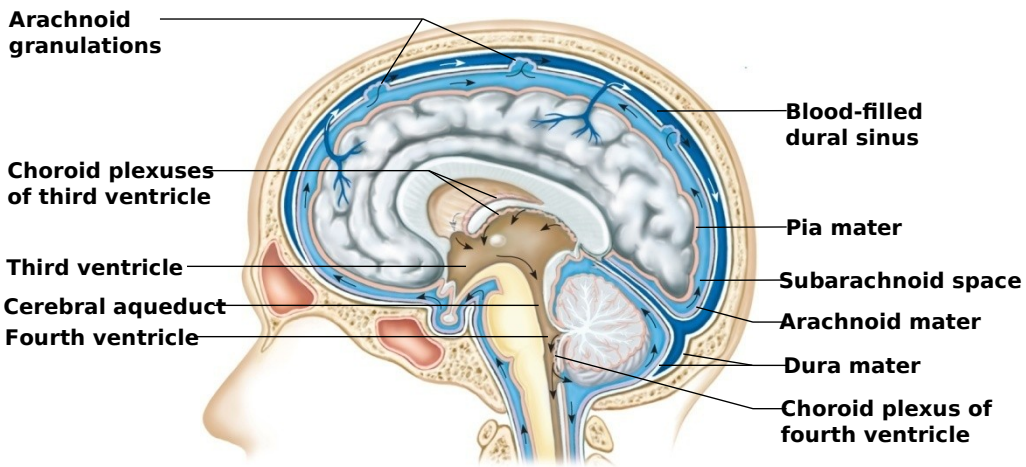

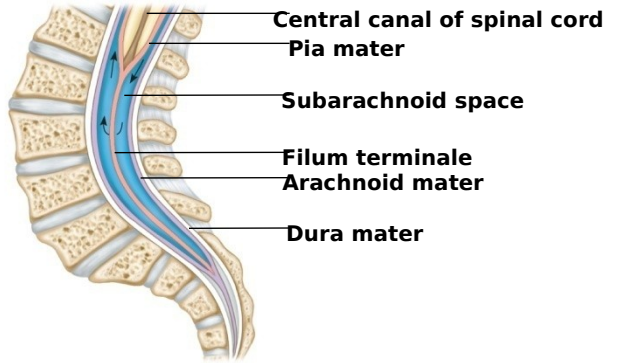

11.4: Spinal Cord

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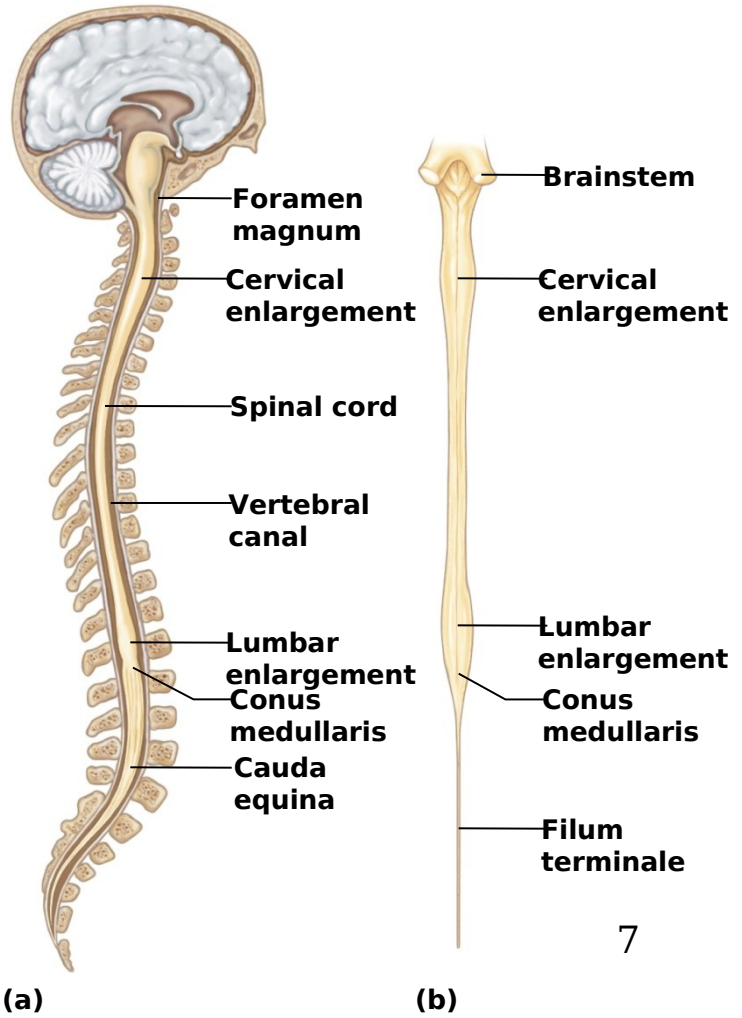
- Slender column of nervous tissue continuous with brain and brainstem
- Extends downward through vertebral canal
- Begins at the foramen magnum and terminates at the first and second lumbar vertebrae (L1/L2) interspace



Structure of the Spinal Cord

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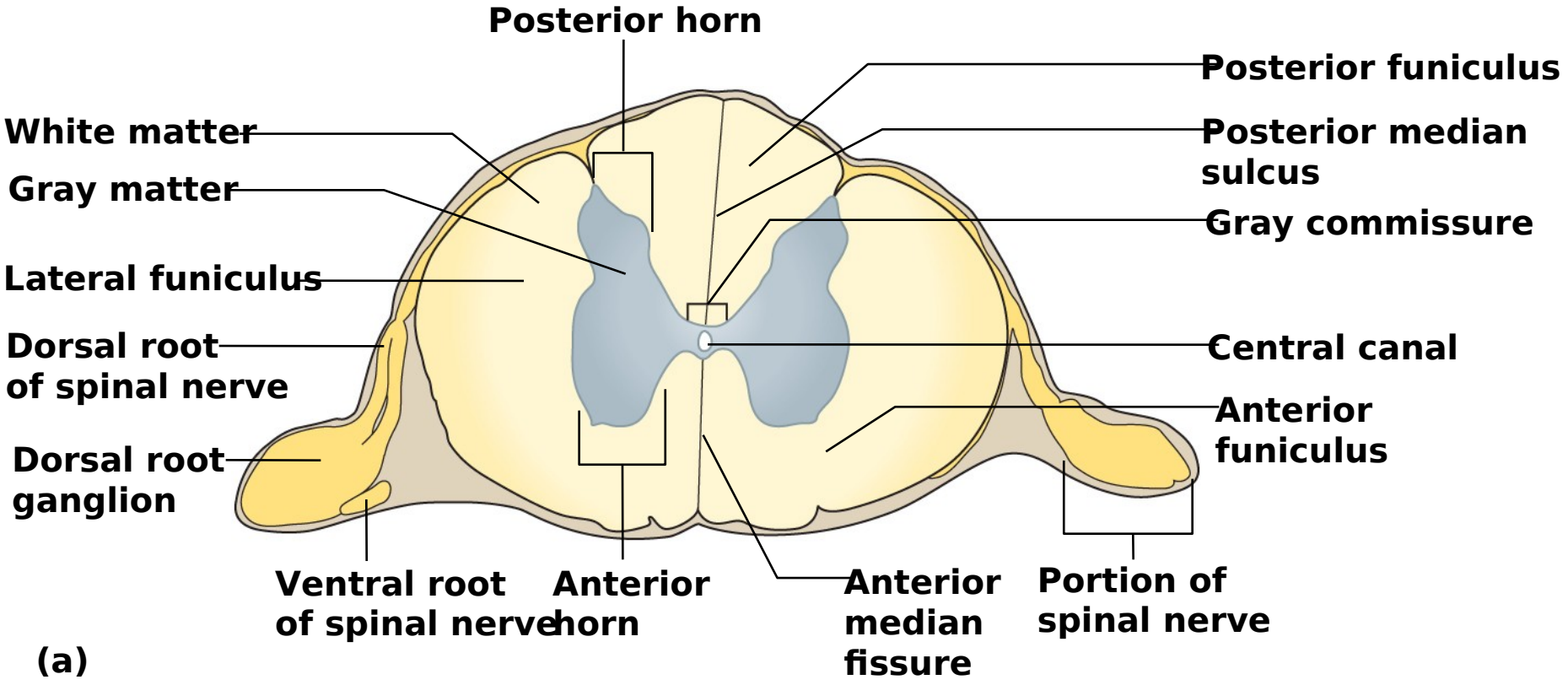

Functions of Spinal Cord

- Conduit for nerve impulses to and from the brain and brainstem
- Center for spinal reflexes

Reflex Arcs

- Reflexes are automatic, subconscious responses to stimuli within or outside the body
  - Simple reflex arc (sensory – motor)
  - Most common reflex arc (sensory – association – motor)

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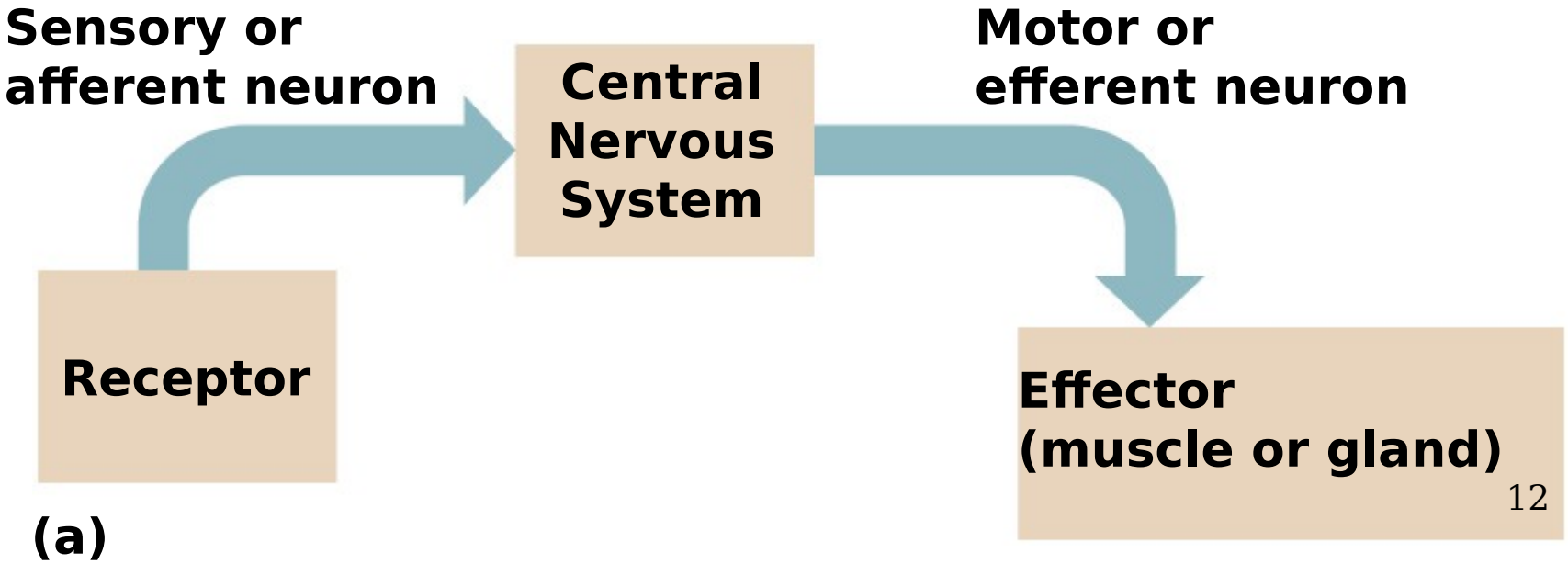

Reflex Arcs

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TABLE 11.2 | Parts of a Reflex Arc

Part	Description	Function
Receptor	The receptor end of a dendrite or a specialized receptor cell in a sensory organ	Sensitive to a specific type of internal or external change
Sensory neuron	Dendrite, cell body, and axon of a sensory neuron	Transmits nerve impulse from the receptor into the brain or spinal cord
Interneuron	Dendrite, cell body, and axon of a neuron within the brain or spinal cord	Serves as processing center; conducts nerve impulse from the sensory neuron to a motor neuron
Motor neuron	Dendrite, cell body, and axon of a motor neuron	Transmits nerve impulse from the brain or spinal cord out to an effector
Effector	A muscle or gland	Responds to stimulation by the motor neuron and produces the reflex or behavioral action

General Components of a Spinal Reflex

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